REMARKS

In the Final Office Action, the Examiner rejected claims 1-25 and 28-40 and indicated that claims 26 and 27 contain allowable subject matter. The present Response neither amends nor cancels any of the pending claims. Thus, claims 1-40 remain pending in the present application and are believed to be in condition for allowance. Reconsideration and allowance are all pending claims are respectfully requested in view of the following remarks.

Claim Rejections under Doctrine of Obviousness-Type Double Patenting

In the Final Office Action, the Examiner provisionally rejected claims 1-25 and 28-40 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-32 of co-pending Application No. 10/723,894 and rejected claims 1-25 and 28-40 over claims 1-10 of U.S. Patent No. 7,756,565. *See* Final Office Action, page 3. Although Applicants do not necessarily agree that claims 1-25 and 28-40 are obvious over claims 1-32 of co-pending Application No. 10/723,894 or claims 1-10 of U.S. Patent No. 7,756,565, Applicants may be willing to file a terminal disclaimer, if necessary, when the presently pending claims are indicated as allowable. Accordingly, Applicants respectfully request that the Examiner hold the obviousness-type double patenting rejection in abeyance until the present or co-pending claims are indicated as allowable.

Claim Rejections Under 35 U.S.C. §102

In the Final Office Action, the Examiner rejected claims 8-14, 20-24, 31-36, and 38-40 under 35 U.S.C. §102(b) as being anticipated by Huesman et al., *Preliminary Studies of Cardiac Motion in Positron Emission Tomography* (2001), Pages 1-12 (hereinafter "the Huesman reference"). Applicants respectfully traverse this rejection.

Legal Precedent

Anticipation under Section 102 can be found only if a single reference shows exactly what is claimed. *See Titanium Metals Corp. v. Banner*, 227 U.S.P.Q. 773 (Fed.

Cir.1985). For a prior art reference to anticipate under Section 102, every element of the claimed invention must be identically shown in a single reference. *See In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir.1990). That is, the prior art reference must show the *identical invention "in as complete detail as contained in the ... claim"* to support a *prima facie* case of anticipation. *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989) (emphasis added). Thus, for anticipation, the cited reference must not only disclose all of the recited features but must also disclose the *part-to-part relationships* between these features. *See Lindermann Maschinenfabrik GMBH v. American Hoist & Derrick*, 221 U.S.P.Q. 481, 486 (Fed. Cir.1984). Accordingly, Applicants need only point to a single element or claimed relationship not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter.

Independent Claims 8, 20, 31, 38, and 40

Applicants respectfully traverse the rejection of independent claims 8, 20, 31, 38, and 40. Specifically, Applicants note that independent claims 8, 20, 31, 38 and 40 are variously directed towards methods, computer-readable tangible media and imaging systems and each recite the extraction of two or more prospective gating points *and* <u>one or more motion compensation factors</u> via the processing of a set of motion data. Support for these recited features may be found at least in Fig. 4, as well as on page 16 of the Specification. For instance, with regard to the flow chart depicted in Fig. 4, the Specification states that once quiescent periods 88 are identified, the quiescent periods may be used to determine one or more motion compensation factors 106. *See* Specification, page 16, line 17-27. For example, the determination of such motion compensation factors 106 may include modeling anticipated motion based on the multi-input motion data 72 and/or quiescent periods 88. *See id.* Additionally, the motion compensation factors 106 may be determined using a priori information about the organ of interest. *See id.*

In setting forth the present rejection, the Examiner asserted that every feature recited by independent claims 8, 20, 31, 38 and 40 is disclosed by the Huesman reference. Specifically, the entirety of the Examiner's rejection based upon Huesman states:

> Huesman et al (hereinafter Huesman) discloses an image system which must inherently contain a computer program, and a method for imaging the heart with means and steps for double-gating the image data for both respiratory and cardiac motion correction (Abstract). Huesman discloses means and steps for acquiring motion data for the lungs and the heart using both an EKG and a pneumatic bellows apparatus (pg. 6, par. 1), which constitute an electrical sensor with measurement system, and non-electrical sensor with measurement system, respectively, as claims in the instant application. Huesman extracts two prospective gating points, end inspiration and end expiration, and two retrospective gating points, end diastole and end-systole (Fig. 7). Huesman also discloses means and steps for acquiring image data of the heart and subsequently processing a portion of the image data to compensate for motion artifacts, including means and steps for reconstructing and displaying the image (pg. 9, par. 1; Fig. 7).
>
> Final Office Action, page 4.

Applicants respectfully submit that the statements provided by the Examiner in support of the proposed Section 102 rejection do not appear to address the recited motion compensation factors of independent claims 8, 20, 31, 38 and 40. Indeed, while the Examiner has identified certain elements disclosed in the Huesman reference (e.g., EKG, pneumatic bellows, the extraction of gating points) as purportedly corresponding to certain recited features of independent claims 8, 20, 31, 38, 40, the rejection is vague as to whether the Examiner specifically identified what element of the Huesman reference is believed to correspond to the recited *motion compensation factors*.

As best understood, it appears that the Examiner is asserting paragraph 1 of page 9 of the Huesman reference as teaching a process of "subsequently processing a portion of the image data *to compensate for motion artifacts*." *Id* (emphasis added). In reviewing the Huesman reference, Applicants note that the entirety of the cited passage states:

> **5. Discussion**
> Our basic strategy for motion correction is to acquire PET data which are gated with respect to both the cardiac and respiratory cycles. The simplest approach would be to restrict attention to a single point in the cardiac/respiratory cycle such as end-diastole/end-expiration. However, this would use only a small fraction of the acquired data, resulting in an unacceptable loss of statistical information. If both the respiratory and contractile components of heart motion are independent and can be reliably tracked from external cues, the approach can be improved by registering and summing all reconstructed volume image datasets for each cardiac gate. Registration aligns the myocardium in each respiratory gating phase to the myocardium in the end-expiration respiratory gating phase. The result will be a volume image for each phase of the cardiac contractile gating cycle in which respiratory motion artifacts have been removed from the myocardium. Stationary structures and structures that appear in an emission image which move differently than the heart, such as the liver, will be blurred in this process, but the object of this work is artifact removal from the heart at the expense of artifact generation elsewhere in the image volume.
>
> Huesman, pages 8-9.

From these teachings of Huesman, the above-cited passage appears to merely state that by summing and registering reconstructed images acquired at the cardiac gating points, respiratory motion artifacts may be reduced/removed when imaging a heart. However, Applicants respectfully submit that is wholly unclear as to what specific element(s) disclosed in the above-cited passage the Examiner is asserting as being the recited *motion compensation factors*. Applicants respectfully remind the Examiner that "[w]hen a

reference is complex or shows or describes inventions other than that claimed by the applicant, *the particular part relied on must be designated as nearly as practicable*. The pertinence of each reference, if not apparent, *must be clearly explained* and each rejected claim specified." 37 C.F.R. §1.104(c)(2).

With this mind, Applicants further note that the term "motion compensation factor" does not appear anywhere in the cited passages of Huesman. Further, if the Examiner is intending to assert the step of image registration as being a motion compensation factor, Applicants note that the cited passage of Huesman reference clearly states that registration is performed on <u>image data</u>. That is, even assuming *arguendo* that the registration of images could be considered as the recited motion compensation factor(s) (which Applicants do not concede), the Huesman reference clearly describes the registration process as being performed by processing *image data* (e.g., summing and processing *reconstructed image datasets*). In contrast, independent claims 8, 20, 31, 38, and 40 clearly recite that one or more motion compensation factors are extracted by processing *motion data* (e.g., acquired via a motion sensor).

In view of these deficiencies, among others, no *prima facie* case of anticipation is believed to exist with regard to independent claims 8, 20, 31, 38, and 40 based on the Huesman reference. Accordingly, Applicants respectfully request that the Examiner withdraw the rejection under 35 U.S.C. § 102(b) of independent claims 8, 20, 31, 38, and 40, as well as their respective dependent claims.

Independent Claim 39

Independent claim 39 recites, *inter alia*, "data processing circuitry ... configured to <u>validate [a] set of motion data using another set of motion data derived from a dataset acquired by [a] imager</u>." (Emphasis added). At least this feature is believed to be absent from the Huesman reference. Particularly, referring to the text of the rejection based on Huesman (provided above), it does not appear that Examiner even addressed this recited

feature of independent claim 39. That is, the Examiner does not cite any teaching from Huesman as allegedly corresponding to or teaching the validation of motion data using another set of motion data. Indeed, after careful review, Applicants are unable to identify any language in the Huesman reference that teaches or suggests *validating* a set of motion data using *another* set of motion data derived from an imager.

Accordingly, no *prima facie* case of anticipation is believed to exist with regard to independent claim 39 based on the Huesman reference. Therefore, Applicants respectfully request that the Examiner withdraw the rejection under 35 U.S.C. § 102(b) of independent claim 39.

Claim Rejections Under 35 U.S.C. §103

In the Final Office Action, the Examiner rejected claims 1-25 and 28-40 under 35 U.S.C. §103(a) as being unpatentable over Yuan et al., *Cardiac-Respiratory Gating Method for Magnetic Resonance Imaging of the Heart*, Magnetic Resonance in Medicine, vol. 43, pages 314-318 (hereinafter "the Yuan reference") in view of at least one of Felblinger et al., *Methods and Reproducibility of Cardiac/respiratory Double-Triggered ^{1}H-MR Spectroscopy of the Human Heart*, Magnetic Resonance in Medication, vol. 42, pages 903-910 (1999) (hereinafter "the Felblinger reference"), Stuber et al., *Submillimeter Three-Dimensional Coronary MR Angiography with Real-time Navigator Correction: Comparison of Navigator Locations*, Radiology, vol. 212, pages 579-587 (1999) (hereinafter "the Stuber reference"), and Manke et al., *Novel Prospective Respiratory Motion Correction Approach for Free-Breathing Coronary MR Angiography Using a Patient-Adapted Affine Motion Model*, Magnetic Resonance in Medicine, vol. 50, pages 122-131 (hereinafter "the Manke reference"). Applicants respectfully traverse these rejections.

Legal Precedent

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). In addressing obviousness determinations under 35 U.S.C. §103, the Supreme Court in *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727 (2007), reaffirmed many of its precedents relating to obviousness including its holding in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). In *KSR*, the Court also reaffirmed that "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *Id.* at 1741. In this regard, the *KSR* court stated that "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does ... because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *Id.* Furthermore, the *KSR* court did not diminish the requirement for objective evidence of obviousness. *Id.* ("To facilitate review, this analysis should be made explicit. See *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness")). As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ."); *see also In re Lee*, 61 U.S.P.Q.2d 1430, 1436 (Fed. Cir. 2002) (holding that the factual inquiry whether to combine references must be thorough and searching, and that it must be based on *objective evidence* of record).

Deficiencies of the Rejection of Independent Claims 1, 15, 25, 37, and 39

Independent claim 1 recites a method comprising, *inter alia*, "acquiring a set of motion data for one or more organs using one or more sensors" and "validating the set of motion data using another set of motion data derived from a dataset acquired via an imager." (Emphasis added). Independent claims 15 and 37, as amended, are directed towards a computer program (e.g., computer readable media storing executable code) and an imaging system adapted to perform the method recited by independent claim 1. Independent claims 25 and 39 also recite imaging systems that include an imager and data processing circuitry configured to validate a set of motion data obtained using one or more sensors by using another set of motion data derived from a dataset acquired via the imager.

Support for these recited features may be found at least in Figs. 2 and 4, as well as on pages 11 and 16 of the Specification. For instance, the Specification notes that a variety of processes may be used for detecting and/or measuring organ motion, including image-based detection and/or measurement (block 50 of Fig. 2), which may include acquisition data (block 60) or pre-acquisition data (block 56). *See* Specification, page 10, line 31 – page 11, line 21. Additionally, with regard to the flow chart depicted in Fig. 4, the Specification further states that motion data acquired via electrical and/or non-electrical sensors may be validated using *another set* of motion data derived or computed (either in one dimension or in two dimensions) from either unreconstructed or reconstructed acquisition image data. *See id.* at page 16, lines 1-4.

In setting forth the present rejection of independent claims 1, 15, 25, 37, and 39 under Section 103, the Examiner acknowledged that these features are absent from the Yuan reference. *See* Final Office Action, page 6. However, the Examiner asserted that the Stuber reference cures this deficiency. Specifically, the Examiner stated "Stuber suggests that navigators with gating and real-time motion correction result in improved imaging and suggests using a model that incorporates the relationship between

diaphragmatic motion and coronary displacement may be used for real-time motion correction." *Id* (citing Stuber, pages 579, 581-582). The Examiner then alleged that the disclosed use of navigator pulses with gating may be interpreted as validating ECG data with MR navigation data because the navigation data enables the system or method to reject potentially poor image data. After carefully reviewing the cited passages of Stuber, Applicants respectfully disagree with the Examiner's assertion that the cited portions of Stuber teach the validation of motion data using another set of motion data derived by an imager.

As best understood by the Applicants, the Stuber reference generally discusses a technique for using a combination of an EKG signal measuring heart activity and MR navigator data measuring the inspiratory/expiratory states of the lungs to define a gating window for imaging, such that the acquired data exhibits reduction in motion artifacts. For instance, Fig. 3 of the Stuber reference clearly shows that the EKG signal is used as a triggering signal to identify potential image acquisition times between QRS waves of the EKG signal. Further, the potential image acquisition times are accepted (e.g., referred to in Stuber as an "accepted profile") only if they occur within a gating window that spans an interval of time where a subject's breathing is near an end-expiratory state. Thus, the Stuber reference appears to teach that when potential image acquisition times occur *within* the defined gating window, image data corresponding to those acquisition times is reconstructed and, if the potential acquisition time occurs *outside* the defined gating window, image data corresponding to those times is *not* reconstructed.

As noted above, the Examiner, in setting forth the present rejection, appears to allege that the EKG signal of Stuber is validated using MR navigator data. However, Applicants are unable to locate any language in the Stuber reference which teaches or suggests that the EKG signal itself is validated. As discussed above, the EKG signal is simply used as a trigger signal to identify potential image acquisition/reconstruction times. The MR navigator data is used to select certain acquisition times based upon the

respiratory state of the subject, i.e., whether the respiratory state falls within the defined gating window (near the end-expiratory level). However, Applicants do not believe that there is anything about these teachings which suggests that the EKG signal (which is representative of polarization/depolarization of the heart) is validated (e.g., checked for accuracy or correctness) in any way.

Accordingly, Applicants respectfully submit that the Stuber reference fails to cure the admitted deficiencies of the Yuan reference. Additionally, the Felblinger and Manke references also do not appear to obviate the deficiencies of the Yuan reference, and the Examiner did not indicate that they were relied upon in this regard. Thus, for at least these reasons, no *prima facie* case of obviousness is believed to exist with regard to independent claims 1, 15, 25, 37, and 39 based on any combination of the Yuan, Stuber, Felblinger, or Manke references. As such, Applicants respectfully request that the Examiner withdraw the rejection under 35 U.S.C. §103(a) of independent claims 1, 15, 25, 37, and 39, as well as their respective dependent claims.

Deficiencies of the Rejection of Independent Claims 8, 20, 31, 38, and 40

As discussed above in Applicants' remarks addressing the Section 102 rejections, each of independent claims 8, 20, 31, 38, and 40 recites the extraction of two or more prospective gating points *and* <u>one or more motion compensation factors</u> via the processing of a set of motion data.

In setting forth the present rejection of independent claims 8, 20, 31, 38, and 40 under Section 103, the Examiner acknowledged that these features are absent from the Yuan reference. *See* Final Office Action, page 6. However, the Final Office Action is unclear as to which cited secondary reference is being alleged of curing the deficiencies of the Yuan reference. Indeed, after carefully reviewing the Examiner's statements, Applicants note that the Examiner does not appear to specifically identify, in either the text of the Section 103 rejections or in the Response to Arguments section, which secondary

reference is believed to teach the extraction of motion compensation factors by processing a set of motion data.

For instance, to generally summarize, the Examiner indicated that the Stuber reference was being cited in combination with the Yuan reference as allegedly teaching the validation of motion data using another set of motion data acquired via an imager. *See id.* at page 7. The Examiner also indicated that the Felblinger reference was being cited in combination with the Yuan reference as allegedly teaching methods of cardiac/respiratory double-triggered imaging using various methods which may include ECG triggering and MR navigator scans, and related techniques for achieving the reproducibility of such methods. *See id.* at pages 6-7. Further, the Examiner indicated that the Manke reference was being cited in combination with the Yuan reference as allegedly teaching the use of prospective gating points to account for irregular breathing patterns, as determined by pre-acquisition scan data and/or supplementing navigator data with vector EKG data. *See id.* at pages 7-8. However, based solely on these assertions, Applicants are unable to identify which reference or references the Examiner intended to cite as obviating the admitted deficiencies of Yuan with regard to independent claims 8, 20, 31, 38, and 40, i.e., the extraction of one or more motion compensation factors by processing a set of motion data. Additionally, Applicants have reviewed each of the secondary references and do not believe that any of the cited references discloses or suggests the extraction of a motion compensation factor <u>and</u> a prospective gating point by processing a set of motion data.

Accordingly, since it appears that the Examiner has failed to specifically set forth which of the secondary references (e.g., Stuber, Felblinger, or Manke) is being alleged as disclosing motion compensation factors, and also failed to provide any statements to clarify the Examiner's interpretation of these references, Applicants submit that the Yuan reference in combination with one or more of the Felblinger, Stuber, and Manke references do not appear to teach or suggest the extraction of two or more prospective

gating points *and* one or more motion compensation factors via the processing of a set of motion data, as recited by independent claims 8, 20, 31, 38, and 40 and, therefore, cannot support a *prima facie* case of obviousness against these independent claims. As such, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. §103(a) of independent claims 8, 20, 31, 38, and 40, as well as their respective dependent claims.

Further, Applicants stress that 37 C.F.R. §1.104 requires that "[w]hen a reference is complex or shows or describes inventions other than that claimed by the applicant, the pertinence of each reference, if not apparent, must be clearly explained and each rejected claim specified." 37 C.F.R. §1.104(c)(2). (Emphasis added). Thus, if the Examiner chooses to clarify the Section 103 rejection of claims 8, 20, 31, 38, and 40 in a subsequent Office Action, Applicants respectfully request that the Examiner make subsequent Office Action a non-final action in order to provide Applicants with a fair opportunity to respond.

Dependent Claims 3, 10, 17, and 22

Claims 3, 10, 17, and 22 depend from independent claims 1, 8, 15, and 20, respectively, and each generally recite fusing a set of image data representative of structure with at least one of either image data representative of motion or an image data set representative of electrical activity. By way of example, the Specification states that image data may be fused, such that motion data (either electrical or non-electrical) derived from the multi-input motion data set 72 may be combined with image data (e.g., a reconstructed structural image of an organ) to visually convey motion, acceleration, displacement, polarization, or some other sensed parameter in conjunction with structure. *See* Specification, page 18, lines 22-28.

In the Final Office Action, the Examiner provided wholly conflicting statements as to whether the Yuan reference discloses the fusing of image data sets. For instance, on pages 5-6 and page 9 of the Final Office Action, the Examiner asserted that the Yuan reference does teach the fusing of image data sets. However, on page 6 of the Final Office Action, the Examiner contradicts these statements by stating that the Yuan reference does not expressly teach fusing image data. As discussed below, Applicants do not believe that the Yuan reference or any of the cited secondary reference discloses this recited feature. However, should the Examiner choose to provide revised or clarifying statements in a subsequent communication to address the present contradictory statements regarding the Yuan reference, Applicants again request that the Examiner do so in a subsequent non-final Office Action.

Notwithstanding this contradiction, Applicants note that the Examiner asserted that the "Analysis" and "Discussion" sections on page 315 and 317 of the Yuan reference disclose the fusing of image data sets with at least an image data set representative of either motion or electrical activity. The entirety of these cited passages is reproduced below:

> **Analysis**
> End-systolic long-axis images of the left ventricle (LV) in normal volunteers with one-dimensional SPAMM tags perpendicular to the LV long axis across the heart wall were analyzed for the comparison of the three respiratory conditions. A custom-written IDL (Interactive Data Language, Research Systems Inc., Boulder, CO) program was used to manually extract the signal intensity profile of the tags on the lateral free wall of the left ventricle. The profile was interpolated using a sinc function through zero filling of the Fourier transform of this function in the corresponding k-space. First-order baseline correction was also performed on the tag profile to compensate for the image nonuniformity due to the use of phased-array receiver coils. From the profile function, the full width at half-maximum (FWHM) of the tag and the maximum

signal intensity difference between tag and myocardium (background) were then computed, which mathematically define the tag sharpness and the tag-myocardium contrast, respectively. Statistical differences in either FWHM of the tags or tag-myocardium contrast among the three respiratory conditions across the eight volunteers were studied using a single factor analysis of variance (ANOVA) (Statview, Abacus Concepts, Inc., Berkeley, CA). A level of $p < 0.05$ was considered statistically significant. When ANOVA analysis determined that the effects of the above two variables were significantly different, multiple comparisons were performed using the Scheffe's test, which provided all possible pair-wise comparisons of means of these variables among the respiratory conditions.

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Discussion

We have demonstrated that both cardiac-respiratory gating and breath-hold methods significantly reduce respiratory motion artifacts in tagged cardiac MR images. One-dimensional tags embedded in myocardium provide us a semi-quantitative estimate of motion artifact reduction. The FWHM of the tag and the maximum signal intensity difference between tag and the myocardium were determined in order to characterize the tag sharpness as well as the tag-myocardium contrast. However, this method has its limitations. In the comparison study, three out of the eight volunteers showed no improvement of average FWHM of the tags during cardiac-respiratory gating and breath-hold compared to free breathing without respiratory gating. On the images obtained during free breathing without respiratory gating, thinner tags were observed due to fading from the motion, which might have resulted in a smaller apparent FWHM of the tags measured, despite the actual motion blurring.

In cardiac functional studies using tagging techniques, good contrast between the tags and myocardium is essential in image analysis. Breath-hold cardiac-gated fast imaging techniques improve image contrast by eliminating respiratory motion. In the cardiac-respiratory gating approach, ECG triggers were only passed through to initiate image acquisition at or near end-expiration. The increased signal intensity of myocardium

due to magnetization recovery during inspiration enhanced image contrast; however, it also caused k-space modulation, which could result in image artifacts and edge corruption. In our study, signal averaging was often used in order to increase SNR in high temporal and spatial resolution images. Over-sampling of k-space (made possible by respiratory gating) was performed to exclude aliasing artifacts in the image. The measured tag-myocardium contrast was found to be greater during cardiac-respiratory gating compared to breath-hold. No tag edge corruption was observed in cardiac-respiratory gated images.

Using the dual cardiac-respiratory gating device, MR echoes are acquired only during the expiration phase of respiration. Single image data acquisition time is prolonged 1.5-4 times compared to breath-hold data acquisition, depending on the heart rate and respiratory rate. However, additional respiration recovery time between images is needed in breath-hold studies. The total imaging time is thus approximately the same in multi-location cardiac MR studies using these two methods. Since respiratory gating does not require respiration suspension, it avoids potential changes in the heart rate and function during prolonged breath-holds, or changes in the heart location due to differing breath-holds. It also avoids data loss due to the patient's inability to cooperate with prolonged and repeated breath-holds. In patients with higher heart rate and lower respiratory rate, the efficiency of cardiac-respiratory gating improves. In our cardiac tagging study, the fast gradient echo imaging sequence (FASTCARD, GE) used was designed so that multiphase tagged cardiac images at one location could be acquired within a single breath-hold. The conventional phase encoding reordering technique is not supported with this technique. Hence, we have left the comparison of phase encoding reordering respiratory compensation techniques and our method for future study.

Using a bellows-type device to monitor respiration is easier to implement in standard clinical MRI environments compared to the navigator echo technique. It requires little software modification if an external trigger input is available. If not, the output signal from the gating device can be connected directly to an LED, which can

> trigger the photopulse sensor of a peripheral gating system of the scanner. Another advantage of using the external ECG trigger device is that the QRS detection circuitry can suppress the enlarged T-wave due to blood flow in the magnetic field, which may be further increased in response to medication such as dobutamine during MRI cardiac stress tests.
>
> Yuan, pages 315, 317.

Applicants note that these are the same passages of the Yuan reference that were cited in the previous Office Action against claims 3, 10, 17, and 22. As discussed in the previous Response filed on December 1, 2009, the "Analysis" section of the Yuan reference generally discusses the comparison of cardiac images obtained from multiple volunteers to identify respiratory conditions. The cited "Discussion" section appears to merely summarize that the image acquisition technique disclosed by Yuan significantly reduces motion artifacts in MR imaging, but with the noted drawback of increasing image acquisition times (e.g., 1.5 to 4 times longer). However, contrary to the Examiner's assertions, Applicants, after carefully reviewing the cited passages of the Yuan reference, are unable to identify any language teaching or suggesting the fusing of image data sets, as recited by dependent claims 3, 10, 17, and 22.

In the Response to Argument section on page 9 of the Final Office Action, the Examiner remarked that "visual conveyance [of depolarization states] is not required by the claim language." Final Office Action, page 9. While it is unclear as to what the Examiner intended by this statement, Applicants agree that neither of claims 3, 10, 17, or 22 require or recite visually conveying depolarization states. Rather, Applicants merely provided the visual conveyance of depolarization states (as well as motion, acceleration, displacement, etc.) as an example of what one skilled in the art could expect to see in one such fused image set, as disclosed in the Specification.

For at least the reasons discussed above, Applicants respectfully submit that dependent claims 3, 10, 17, and 22 are allowable not only by virtue of their dependency from claims 1, 8, 15, and 20, respectively, but also for the subject matter separately recited.

Allowable Subject Matter

In the Final Office Action, the Examiner objected to claims 26 and 27 as being dependent upon rejected base claims, but stated that these claims would be allowable if rewritten into independent form to include all of the limitations of their respective base claims and any intervening claims. *See* Final Office Action, page 8. Applicants would like to thank the Examiner for indicating the potential allowability of claims 26 and 27. However, in view of the remarks set forth above, Applicants believe that all of the pending claims are allowable and have thus chosen not to rewrite claims 26 or 27 into independent form at this time.

Conclusion

In view of the remarks set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

Date: September 20, 2010

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